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Real Estate Economists, Appraisers and Counselors

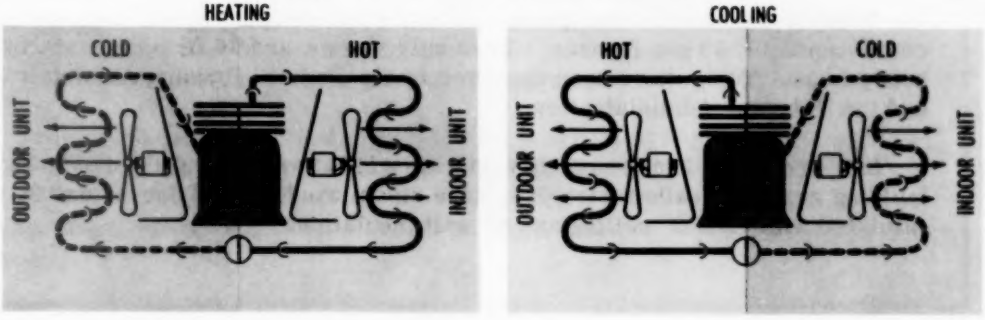
THE HEAT PUMP

HOW does the presence of a heat pump affect the value of a residence? If the appraiser has not encountered this problem, he will eventually. The purpose of this bulletin is to furnish information as to the practicability, operation and costs of heat pump installations, with the emphasis on residential use. Commercial buildings have so many special problems, due to the wide variance in type, size and use, that they are not considered here.

The idea of a heat pump is not new, having been the dream of many foresighted engineers more than a century ago. However, it did not become a reality until shortly after World War I when the first few heat pumps appeared in Europe. The first heat pumps in the United States were installed in New Jersey in 1935. Today there are some 30,000 in operation in this country, most of which are found in the South and Southwest with relatively few found in the North, where extreme temperature changes are experienced.

The heat pump is a device that pumps heat into the building in winter and out of the building in summer. It burns no fuel, requires no chimney, it filters and dehumidifies the air. It uses only electricity and air or water. Fundamentally, there is no difference between a conventional refrigeration system and the "heat pump system." Thermodynamically, both systems are the same in that they absorb heat at a low temperature level and reject it at a higher temperature level. Heat exists in all substances down to 459.6° F. below zero, which is known as absolute zero.

HOW A HEAT PUMP WORKS



The Air-to-Air Type extracts heat from the atmosphere, is stepped up by a compressor which supplements the heat taken from the air by the heat equivalent of electricity used to run the compressor. The lower the outside temperature, the harder the heat pump must work to warm the building. Heat pumps come with built-in electric resistance units to supply additional heat and defrosting where the winter temperature occasionally drops very low. The big advantage of the air-to-air type is that there is no place without air and it can be had free in unlimited quantity.

The Ground-to-Air Type extracts heat from the earth. There is a great reservoir of heat in the ground below the frost line at practically constant temperature. This natural heat source can be tapped with a ground-to-air heat pump. In this type, a refrigerant is circulated through a system of copper pipes buried 4 or 5 feet below the surface. The liquid refrigerant circulates through the underground pipes, picking up the ground heat. In so doing, the refrigerant changes into a gas. Upon entering the compressor the gas reverts to a liquid, gives up its heat to the building heating system, and returns to the ground to pick up more heat. The process is reversed for cooling. This type has some drawbacks. It is costly to buy and bury several hundred feet of copper pipe in the first instance and it is costly to dig up the pipes in case of needed repairs.

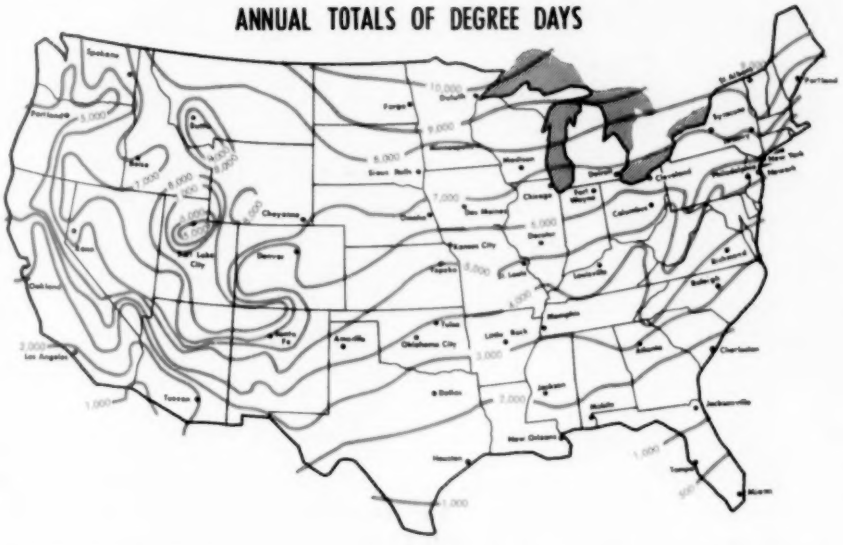
The Water-to-Air Type extracts heat from a natural body of water such as a river, lake or well. Well water is an excellent source of heat which seldom falls below 45^{O} F. in this country. The water is pumped from its source into a condenser, where the refrigerant coil absorbs heat from it to warm the building. The water from which the heat has been extracted may be discharged down the drain, or in areas where water is scarce, it may be returned to its source so that the water table is not affected. In the latter instance the water is merely borrowed for a few minutes and returned. The water-to-air type is found usually in coastal areas, where water is available in quantity.

All three types of heat pumps are in use today. The simplest installation is the air-to-air type. Much effort and engineering know-how has been put forth in recent years in an effort to improve this type, which seems to be gaining in popularity. Over one-half of the residential and commercial heat pumps are of the air-to-air type.

Today's residential heat pump is comparable in appearance and size to the conventional oil or gas furnace. Presently there are 34 firms manufacturing heat pumps. They have been approved by the Federal Housing Administration and the Veterans Administration.

In order that a heat pump may operate efficiently and economically the building must be weather-stripped, have storm windows and doors, and be well insulated with good 6" ceiling and 4" wall insulation.

The cost of operation depends upon the amount of insulation, the amount of glass area, direction the house faces, and whether the building is situated on high or low ground, and of course geographic location. Average cost of operation in the area served by the Union Electric Company of Missouri is 10¢ to 15¢ per square foot per year for heat and 4¢ to 7¢ per square foot per year for cooling.



An estimate of average operating costs for heating can be made by use of the number of degree days in any given area. The annual total of degree days in different areas of the United States is shown on the map above. A degree day is a unit, based upon temperature difference and time, used in estimating fuel consumption. For any one day, when the mean temperature is less than 65° F., there exist as many degree days as there are Fahrenheit degrees difference in temperature between the mean temperature for the day and 65° F. Annual heating cost can be estimated as follows:

Number of degree days x 1 per 1,000 cubic feet of heated volume x .3 x the kilowatt hour rate = annual heating cost.

Example: 30' x 35' building with 8' ceiling interior measurements contains 8,400 cubic feet of heated volume. If the building were located in a 5,000 degree day area, yearly heating cost would be computed as follows:

5,000 degree days x 8.4 (1 per 1,000 cubic feet) x .3 x $2\frac{1}{2}$¢ (estimated kilowatt hour rate) = $315 annual heating cost.

The exact kilowatt hour rate can be secured from the local electric power company.

Cost of Installation. Complete installation of the air-to-air type in a typical 900 to 1,000 square foot house requires a 3-ton unit and costs from $1,700 to $2,000. A 1,200 to 1,400 square foot house requires a 5-ton unit and costs from $2,300 to $2,500. It was learned that one manufacturer is readying a 3-ton unit to be placed on the market for $1,000.

Since the heat pump has not been in large-scale use for a very long period, it is difficult to give a reliable estimate of its physical life. According to the best information available from well-informed sources, a 15-year life is considered reasonable. It is basically a refrigeration unit and probably would not have as long a life as a conventional heating system.

Heat pumps in residential properties are found principally in houses in the above-average price range. It is doubtful that buildings equipped with heat pumps would resell for higher prices than similar buildings equipped with conventional heating and air-conditioning systems.

One way an appraiser could handle this problem would be to compute the difference in cost of a combination heating–air-conditioning system and the cost of a heat pump installation and treat this difference as depreciation.

The general public seems to know little of the advantages and disadvantages of the heat pump. A sales resistance similar to that which builders experienced when drywall began replacing plaster could develop.

As more efficient methods of production are developed and as the consumer learns more of the advantages of the heat pump, it should become more generally accepted and be able to compete on equal terms with today's conventional heating–air-conditioning systems.

The American public is constantly on the lookout for easier and more comfortable ways of living. There seems little doubt that there will be more and more heat pump installations in future construction.

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